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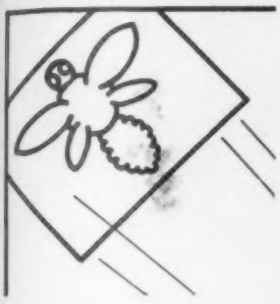
The American Biology Teacher

Vol. 8 APRIL, 1946 No. 7



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PUBLISHED BY
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Publication of the National Association of Biology Teachers.

Issued monthly during the school year from October to May.

Publication Office—N. Queen St. and McGovern Ave., Lancaster, Pa.

Editor-in-Chief—JOHN BREUKELMAN, State Teachers College, Emporia, Kan.

Managing Editor—O. D. ROBERTS, 117 Harrison St., Oak Park, Ill.

Subscriptions, renewals, and notices of change of address should be sent to the Secretary-Treasurer, M. A. RUSSELL, 403 California Ave., Royal Oak, Mich. Correspondence concerning advertising should be sent to the Managing Editor.

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The American Biology Teacher

Vol. 8 APRIL, 1946 No. 7

Models and Modeling

SISTER MARY ETIENNE
Mount Mercy Junior College, Cedar Rapids, Iowa

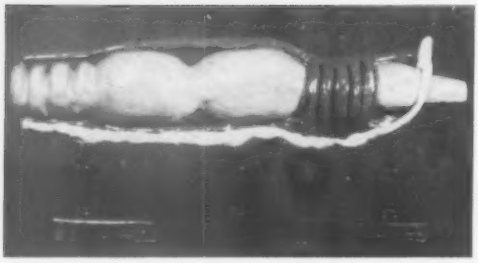
Models in a biology course are intended to supplement rather than replace the more familiar tools of teaching, such as textbooks, demonstrations, experiments, and personal contact between instructor and student.

Live organisms are, of course, the best possible teaching aids and are to be preferred to the most excellent models. A class may be studying an organism and have access to a good textbook, flat pictures, artistic models, skeletons and even preserved materials and still form incorrect concepts unless the instruction begins with live organisms. This is especially true of marine forms.

However, live material is not always available and models *are* a substitute. Accurate, life-size, fully colored, dissectible models are very efficient teaching aids if they are presented to the student at precisely the right time. But a model on a high shelf in a display case is not useful; neither is a model left on a table during the class period effective. The tactful instructor will adroitly bring his class to sense a need for a model and then present it as an aid to visualize the point in question. The psychological moment for using any teaching aid is the time when the student's curiosity is thoroughly aroused and his enthusiasm at its height. To tell a class that they will see a model tomorrow is fatal. Neither the teacher nor the student will be able to build up the same enthusiasm tomorrow.

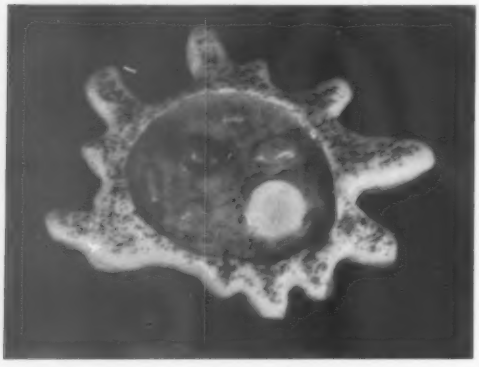
It is well to note that it is often necessary to point out certain limitations in regard to size, color, texture, etc., which are found in the best models, especially those of microscopic organisms and structures. To estimate the approximate magnification with the class has proven interesting and beneficial. For example, the amoeba usually studied in the laboratory is perhaps less than two hundred microns or one-fifth of a millimeter in diameter, and in a sixteen-inch model would be magnified approximately two thousand times.

Models of dissected organisms such as frogs, earthworms, cats, sharks, and the like, are useful in the laboratory in order

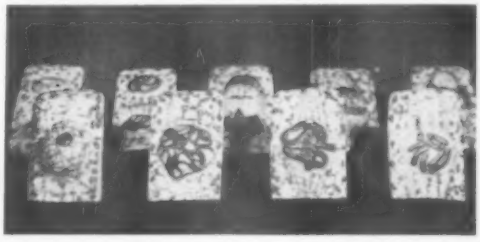


that students may check their own dissections.

Commercial models are expensive and, more often than not, the teacher in the small high school has few, if any, in his laboratory. In such instances one may well resort to modeling. If permanent models are desired, there are many types of inexpensive clay from which they may be molded and then painted when dry. The model of the amoeba illustrated here was made with *Amaco* clay flour in dry form. The following details of the process are offered for the inexperienced teacher.



The amoeba was first studied under the microscope and a suitable drawing made. The size of the model having been determined, the drawing was enlarged to scale. The clay flour was mixed with water and kneaded with the hands until it ceased to be sticky and was free from lumps. A large slab of the clay about three inches thick was then molded on a piece of glass and the drawing traced upon it. When the form had been satisfactorily shaped, the center was hollowed out and a previously molded nucleus, several food vacuoles, and a porcelain evaporating dish (contractile vacuole) were pressed firmly into the moist clay. After several days, the model was painted and while the paint was yet sticky, mustard seeds were sprinkled on it to represent the granules in the protoplasm. When the whole thing was thoroughly dry, it was immersed several times in a pan of melted paraffin. Each immersion added to the transparent coat until the seeds, nucleus and vacuoles were entirely covered and the center nearly filled. Large meat sticks, placed in the clay before it hardened were used to mount the model on a small board.

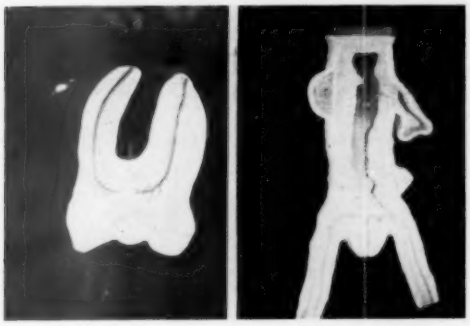


Models of animal and plant mitosis and also of meiosis may be made in the same way. For these, tailor's spools and small meat sticks are excellent for mounting.

In the model of plant mitosis illustrated here, the plastids, nucleoli and chromosomes were made of permoplast in contrasting colors. These adhere to the wet paint and the wax covering makes them permanent. Formation of air bubbles is prevented by slow movement as the model approaches the paraffin during immersion.

In larger models such as the hydra or tooth, it is well to use a framework of wood, wire mesh or pulp to obviate the use of too much clay. This framework or armature may be shellacked if need be. The clay should then be molded in long strips about three-fourths of an

inch thick and laid over the armature side by side. Crosswise modeling with the fingers or a simple modelling tool will blend the strips together. Details may then be added before the clay hardens. An unfinished model may be kept moist indefinitely by inverting a tall jar over it when not being worked.



Modeling from pictures in a textbook or catalouge may have some teaching value but it is far more effective if the student studies the organism carefully and then makes an original model. The model illustrated below was made by two college freshmen to help visualize the digestive tract, circulatory system, circumpharyngeal connectives and subpharyngeal ganglia of the nervous system of the earthworm.

Permoplast in various colors may be used in the laboratory for action demonstration work. This is an inexpensive permanently plastic modeling clay which may be used over and over again for years and serves as a unique way of getting a concept across to the student when words fail.

It is not hard to "sell" an assignment to a class with this type of modeling. It is especially fine in teaching cleavage, mitosis, formation of spores in certain molds, etc.

Excellent directions for teaching cleavage with plastic clay may be found in *Turtox Service Leaflet No. 17** which may be had for the asking. This can be expanded and the different types of cleavage may be molded and compared. If this work is accompanied by oral discussion and followed by a summary of the process and a comparison of types, the results should be very gratifying.

Modeling teeth is an interesting project for high school students. The whole set may be modeled in a period and finally arranged in proper order. If they are made according to a previously worked out scale, they will fit together quite well and details of structure may be studied and discussed.

Occasionally one finds a model of this type which is well worth preserving. This may be done by using Turtox pliamould which is a substance of rubber nature. It is applied to the model with a brush and when hard forms an elastic mold which reproduces the finest details. It may then be filled with casting plaster.

If a permanent demonstration collection is to be built up, it is well to work according to a definite plan which can be carried out over a period of years. To buy models is expensive and to make models is time-consuming. Hence the wise teacher will first determine what models are needed; which ones can be purchased; and then set out to make the others. Additions will be made yearly and old models will be replaced by better ones as the teacher gains in experience.

Storage facilities are also very important. Enclosed cases are necessary since time spent in dusting models is time wasted and neglecting to care for them is money wasted.

In the use of permanent models as well as in action demonstration work, it becomes the teacher's responsibility to see that the student is not merely being entertained. It is easy for the artistic mind to dwell exclusively on beauty of

* General Biological Supply House, 761–3 East 69th Place, Chicago, Illinois.

form and color without adverting to the scientific import of the model. Oral discussion in which the students take active part with frequent references to important details by the teacher will do much to center the attention in the right place. A brief test, oral or written at the close of a modeling period will show the teacher how successful the work has been.

For the convenience of teachers who are not familiar with modeling materials the following list is offered:

From the General Biological Supply House, Chicago, Ill.

Permoplast—5 lb. brick, any color	$1.50
Permoplast—1 lb. brick, four colors	.50
Mexican Pottery clay, powder form	.60 per lb.
Pliamould	.90 per lb.
Ivory casting plaster	.15 per lb.

From the Metropolitan Supply Co., Cedar Rapids, Iowa

Amaco clay flour, dry form—5 lbs.	$.35
Amaco clay flour, moist, ready to use—5 lbs.	.50

Two Simple Demonstrations

DONALD S. LACROIX
Amherst High School, Amherst, Massachusetts

Transpiration

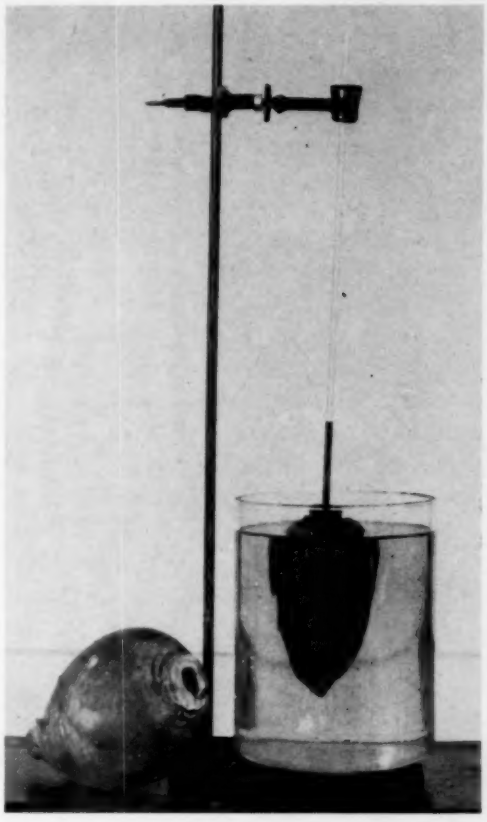
One of the easiest and most direct methods of showing the release of water vapor from leaves is to use a large test tube (about ten inches long and one inch in diameter) instead of the conventional bell jar. Merely insert some leaves on a growing plant into the test tube (without breaking the connection with the rest of the plant), suspend the tube in a clamp on a ring stand and plug the open end with cotton. Water the soil around the plant copiously, and condensed water vapor will appear inside the tube within an hour. The only source of this condensed water vapor is obviously the leaf. Incidentally, if the leaf is a large one, it may be rolled into convenient size for insertion into the test tube without seriously affecting the experiment.

Osmosis

Diffusion of liquids through living tissue can be demonstrated as indicated in the accompanying figure. A large carrot or medium-sized turnip makes excellent experimental material. (Select some that are free from worm-holes.) Using a cork borer or old-fashioned apple-corer, bore a hole from the top of the carrot or turnip well down into the cen-

ter. Fill this hole with a mixture of sugar and ink or syrup and ink. Fit two single-hole stoppers to a 3-foot length of glass tubing—one stopper being placed at one end of the tubing, the second being 18 inches or so above it for clamping the whole assembly to a ringstand. Insert lower stopper and tubing in the hole bored in the carrot and seal with melted paraffine. Place the carrot in a battery jar of water. After a few hours, the ink-stained sugar or syrup will rise in the tube since water is osmosing through the plant tissue into the sugar or syrup. The ink serves to make the liquid in the tube visible at a greater distance.

Many variations of this technique are possible. By using a glass tube of very small bore, a column of liquid 6 or 8 feet in height may be obtained. It is also interesting to try common salt and concentrated solutions of various kinds in place of the sugar.



DO YOU HAVE AN OPAQUE PROJECTOR IN YOUR SCHOOL?

If you have an opaque projector, use it sometime for variety when planning oral reports. Have each pupil make post-card slides on tagboard to illustrate his special topic. When these are done in colors or with appropriate cutouts pasted on, they contribute much to the report. Labels and explanations are important too.

The pride that each pupil has in seeing his own slides seems to add to the effectiveness of putting over his topic. Of course the report has to be prepared well enough to be given without notes. Being in the dark seems to give a certain confidence to the pupil who is often shy when reporting.

Pupils always seem to enjoy their oral reports best when they make use of the opaque projector. Wouldn't you like to try it sometime too?

Helen Drugg,
Keene High School,
Keene, New Hampshire

It was necessary because of lack of space to omit one of the articles originally submitted for the Visual Aids Issue.—*Evaluating Motion Pictures for Biological Science,* by D. W. McCavick of the Visual Instruction Bureau, University of Texas, Austin, Texas. This article, which includes an evaluation chart and a list of previewed and evaluated films, will appear in the May issue.

Also, *Laboratory Aids* by John M. Hamilton and by Rev. John W. Baechle; *The Realm of Nature* by Alfred Novak . . .

The Demonstration Ocular

MARY D. ROGICK
College of New Rochelle, New Rochelle, New York

There are a large number of microscope attachments and accessories which lighten the task of the teacher who takes the time and trouble to learn their use. One such item is the demonstration ocular, which although a wonderfully helpful teaching device and already available for a number of years, does not seem to be as much used or as well known in many institutions as some less useful attachments. Demonstration oculars are made by several leading microscopic manufacturers. Although the models put forth by each differ slightly in details they are alike in essential features. Two models are figured in Figs. 1 and 2.

The demonstration ocular is an L-shaped tube with lenses (or oculars) in each bar (refer to Figs. 1 and 2). It is so constructed that one of the bars can be inserted into the draw tube of the compound microscope in place of the regular microscope ocular. To use the demonstration ocular one simply lifts up and removes the microscope ocular and inserts the demonstration ocular in its place. The instructor then refocuses the microscope while looking through Ocular A (the perpendicular one). Next the student focuses the horizontal Ocular B by turning it slightly (Fig. 1) or by turning the collar D (Fig. 2). The demonstration ocular is now in focus for the instructor and the student. The pointer in Ocular A is visible at both A and B points because of prisms in the tube. It can be operated by either observer.

By use of this demonstration ocular teacher and student both can observe slide material or other objects under the microscope simultaneously and discuss the structures, etc., while looking. Pointing out salient features of the organism can be done with speed, directness, lack of confusion and minimum amount of time by use of this device. It eliminates the widely used method of

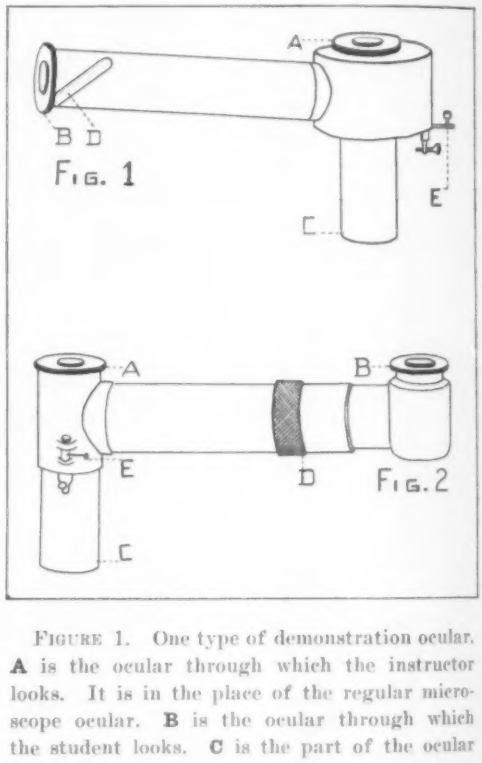


FIG. 1

FIG. 2

FIGURE 1. One type of demonstration ocular. **A** is the ocular through which the instructor looks. It is in the place of the regular microscope ocular. **B** is the ocular through which the student looks. **C** is the part of the ocular which is placed in the draw tube of the microscope. **D** is a groove along which focusing by the student is regulated (by turning ocular **B**). **E** is the pointer which extends into the vertical ocular.

FIGURE 2. Another type of demonstration ocular. The letters **A**, **B**, **C** and **E** represent the same things as in Figure 1. **D** is a collar by which the student focuses ocular **B**. Ocular **B** can be rotated in a complete circle from the vertical position or counter clockwise.

demonstrating material to students, to wit: the teacher squints through the microscope to get a good look at the object, then she backs away to explain it to the student, who then in marvel and bewilderment at such sage observations squints through the microscope in the hope that he too will see the same wonders, then vaguely stares at some big enough looking object in the field of vision, trying to make that fit the teacher's description. Sometimes the teacher's explanation is inadequate or ambiguous so far as the student is concerned. In that event the demonstration ocular can remedy the situation by the teacher pointing directly to the object or structure with the tiny pointer. That centers the student's attention on the right field, on the right structure and the point immediately under discussion. The slide can be moved to show a number of different things while the student and instructor are both looking in at the same time, thus saving the teacher much time, much explanation and considerable bobbing up and down from the microscope. One should always keep in mind when demonstrating things to a student that the student is looking at the object probably for the first time and with relatively untrained eyes. Moreover, he may be looking for something much bigger than the object in question. The pupil because of his inexperience is apt to have some difficulty seeing or interpreting the images in quite the same manner or with the same ease as does the teacher. There is scarcely an instructor who at some time or other has not heard a student ungrammatically and with considerable disappointment remark, "Oh, just *that* little thing is what I am supposed to be looking for?"

An instuctor would find two or three of these demonstration oculars of considerable help in the laboratory. If

FIGURE 3. Diagram of demonstration ocular in use on a microscope.

there is more than one such ocular in the laboratory the instructor can put them to good use in the following way. After explaining and very carefully pointing out some structure to the student the instructor can leave one of the demonstration oculars with that student who will then point out the same things to other students in his immediate vicinity while the instructor busies herself with a student at another table, thus reaching more students in less time. Also, the oculars have been found useful in another way. Some students like to work in pairs. If an extra ocular is available for their use these students manage to help each other considerably sometimes.

The reaction of teachers who have used these demonstration oculars is altogether favorable. They insist that it saves them much time and explanation, that they are sure the students have a much clearer concept of the material and that the oculars make it possible for the

instructor to reach effectively more pupils per period in so far as individual demonstration of material is concerned.

This type ocular provides the student with an opportunity to study the material with the teacher and to ask her what some of the structures are since the student can handle the pointer and set it directly upon the image of the structure he wishes identified.

The instrument is of use in any course which requires a compound microscope. It is of less use with a dissecting microscope.

To Whom We Teach Elementary Science

B. W. McCARTY
Govalle Elementary School, Austin, Texas

In the elementary science program the question of first consideration is not *what* are we to teach but *whom* are we to teach. The answer to this question involves many personal factors of each child such as, what is his C.A., M.A., E.A., health, degree of nervousness, social status, habits, previous experiences, attitudes, and concepts, and who has taught him, as well as what, how, where, and when was he taught? These little bundles of developing, responsive nerves differ not only in sensitivity and native potentialities, but they differ greatly in training and experiences that modified their concepts, attitudes, and interpretations of things and thus made them individuals. However, in the American schools, we may consider that at a given age development and grade experience these individuals are alike in so many ways that we may form a general concept of the average elementary pupil.

Through the centuries of experiences educators have formed ever-changing concepts of the developing normal elementary child. In the accompanying drawing I have with difficulty partially expressed visually a concept of an elementary pupil from a teacher's point of view. This study is not intended to be a physiological treatise on the brain or sensory organs, but it is an attempt to visualize an elementary child as a science teacher might imagine him to be. Hence in the classroom he may be a brain, a bundle of nerves, and a number of sensory organs, or we may say, he is a bundle of responsive nerves leading from sensitive sensory organs to impressionable brain centers that may be intricately correlated and associated. Different areas of the brain may seem to have specific functions and be associated with other areas, and many of these areas have nerve connections directly or indirectly to the sensory organs that contact his environment. Since the child must gain all learning through these sense organs of sight, hearing, feeling, smelling and tasting, they are the teacher's only means of approaching his mind. The ratio of the relative importance of the visual, auditory, tactile sensory organs is emphasized. (Here the term, *tactile* and *feeling* is used to denote all sensory faculties of touch, feeling, movement, etc.) In this picture the teacher may see a need for about a sixty per cent visual, a twenty per cent auditory and an eighteen per cent tactile program, each correlated and integrated with the other. These ratios are general estimates for the average normal child and are based upon concepts formed during many years of teaching experi-

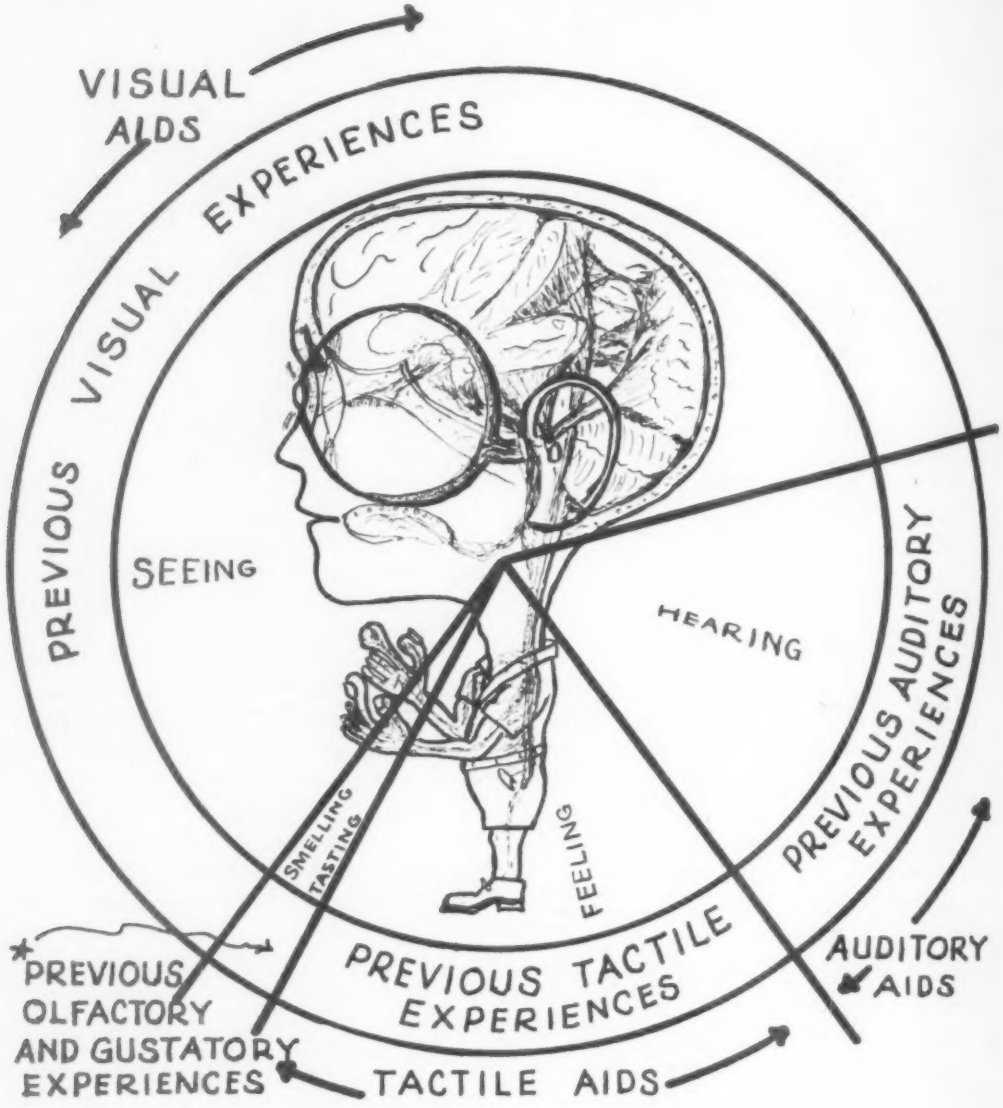
ences and observations rather than upon authoritative data. The effect of these audio-visual-tactile aids and sensations upon the mind is modified by the child's previous preparation to utilize, analyze, perceive, and retain them. Hence in the picture he is surrounded by a frame of previous experiences and, their associations through which he interprets and modifies the impressions and sensations that reach his perception. This modifying condition, of course, exists in the brain centers, but is emphasized in the picture for a visual percept by a flexible, broadening frame of previous experiences about the pupil.

If the science teacher places any pupil in this flexible picture, the ratio boundaries of sense perceptions must be adjusted to fit his age, training, experience, and individual capacities in each of the areas. Also, his previous experience frame must be broadened or adjusted and may not form a uniform circle as is illustrated. Some of his faculties may be superior or inferior as may be the case of the great group of the so-called manually minded pupils. With the normal child it appears that the younger the pupil, the greater the area of feeling and the smaller the hearing area. Thus it becomes evident that this picture must be altered to represent any one child, and changed frequently as "the child grows in stature and wisdom and in favor with God and man." Hence if the teacher presents a child with a story or new information, he may imagine the pupil placed in this picture and adjust the sense areas to fit the many personal factors. He must then place in the previous experience area the pupils peculiar experiences, concepts, fears, interpretations, etc., of these things. He may now know how much and what kind of visual aids, auditory aids, tactile aids, etc., are necessary to accomplish his objective.

The visual area is most highly emphasized in this picture, for when highly educated, the normal eye is the most adaptable sense organ capable of perceiving a wide and distant portion of its environment momentarily. More may be learned of a landscape at a moment's glance than may be comprehended by all the other faculties of perception in months of diligent application. Deep appreciation and information of the beauty of form, shape, color, as well as motion and processes can be obtained by the extremely sensitive and complicated organ of sight and all of its sensory connections and associations that may be involved in the whole process of seeing. But perception through the eyes of the elementary child with all their eventual possibilities is not yet so efficient. There seems to be infinitely more to seeing and visual comprehension than mere sight. Yet with the proper basic experiences and associations with sight the pupil can learn more quickly and effectively many things that comprise American education. We may be justified in stressing visual aids twice as much as all the other aids, providing we associate them properly with auditory and tactile aids.

The importance of **hearing** is recognized in our complex social order. Verbal communications, both written and oral are fundamental to the child's normal education and social happiness; but the interdependence of visual and auditory percepts in the learning process is significant. Much of the elementary child's school program is devoted to the laborious task of learning to read or interpret the printed page or picture, and develop a significant vocabulary through which he may eventually develop abilities to think more abstractly.

The olfactory and gustatory sensations are so much extracurricular that the teacher seldom has opportunity to involve them in the elementary schoolroom. They may be used more in science than in many other fields of study in detecting, recognizing, and appreciating things. But much of the pupils appreciation of foods, flowers, etc., at home and on excursions may be carried over to the schoolroom in his fuller interpretations of words and things, and may be more impor-



A SCIENCE TEACHER'S CONCEPT OF AN ELEMENTARY PUPIL

tant in the whole process of perception than they seem.

Perhaps the most generally underrated approach to learning in the elementary field is the big general field of **tactile sensations** which involves such terms as touch, feeling, kinaesthetic, static, balance, movement, pressure, warmth, cold, and pain. To most children these channels or avenues of sense perception add much to the full appreciation of things about them and may be basic sensations necessary to prevent verbalism. For example: The word dog means little to the child until he has seen one, but his understanding of the word dog is greatly enriched when he handles and plays with one. Thereafter his appreciation of the word or picture of dog will have greater significance.

Usually the normal, inquisitive child is not satisfied until he has handled new things of interest.

The elementary pupil's understanding and appreciation of the meanings of words is so limited that an eloquent verbal discription of new and unassociated things has little real meaning. Hence the science teacher must supplement and enlarge upon the reading teachers foundation by building a vocabulary of simple terms, names of animals, plants, insects, and the like; showing still pictures in color, slides, films, records, specimen, models; and associate elementary stories of the behavior of things and their little ones. We begin building upon the childs little store of information, vocabulary, and experience such information, attitudes, concepts, and habits that will prepare him for further appreciation of life and his environment. We propose to teach him within his limited abilities: to observe more closely, to enjoy more thoroughly, to understand more clearly, and to master and use more efficiently the phenomena of nature and science about him.

As teachers of elementary science, we present things to the child's mind through several sensory channels and make many associations. We let them see, hear, spell, pronounce, talk about, handle, feel, touch, mash, etc. The activity program presents basic concrete percepts of the child's environment upon which he may base his future abstract concepts.

There is a trend to correlate the audio-visual-tactile aids through excursions, plays, demonstrations, mechanical toys, models, objects, specimen, etc. Pupils will keep the elementary science teacher's desk covered with many objects and specimen of local interest. Many of these live specimens, such as squirrels, lizards, frogs, nonpoisonous snakes, fish, and some insects may be domesticated and kept as objects of study in the classroom. Others may be mounted, preserved, or dried. A good learning situation is presented by the presentation of the real thing or model for the child to observe, handle, and ask questions about. One of the trends in the teaching elementary science is to give the child as much first-hand information as possible.

Our armed forces, during the past emergency, have demonstrated the effectiveness of audio-visual-tactile aids, such as actual demonstration and use of models, the use of phonograph and magnetic wire recorder, sound motion pictures, film strips, and slides. There is a trend toward the adoption of smaller, more portable, less expensive, easier operated projection equipment. The 16-mm. sound motion picture, the opaque projector, and the tri-purpose projector may soon be considered essential equipment in every science classroom.

There is a trend to allow the pupils to think through a problem for themselves with the least conspicuous guidance of the teacher; and there is a demand for a continuous correlated program of study so that the child may have a continuous enlargement of his knowledge, and thus be prepared for each succeeding problem. More stress is placed on activity, care for, use, obtain, improve, predict control, select, and growth, as well as child-centered creative expressions, pupil initiative, activity freedom, and preservance of personal identity. Yet we recognize that the teacher must be master of the class situation to guide, promote, and correlate activities in an inconspicuous and tactful manner.

The science teacher is interested in teaching scientific approach procedure and thinking. When attacking problems in elementary science, the pupil may be led to think that he, as a junior scientist, is patient, doesn't give up easily, proves something often, thinks through another's opinions, is willing to change his mind when he finds that he is wrong, and knows that there is a reason for everything that happens. Much

stress is placed upon teaching the child to make careful and accurate observations of phenomena and to think from the tested truth with which he is associated. He is encouraged to begin with a known situation, and with his own ideas, regardless of their inaccuracies and imperfections.

Growth must start where the child is, for he must have meaningful experiences with a problem before the phenomena becomes acceptable to him, and these new meanings may be interpretative of new worlds of deeper understanding. We should have the integration of the interest and experience of the child on the one hand, and the well-thought-out values of the teacher on the other.

As we enter into an atomic age where the youth of America appreciates so much the developments of science, the elementary teacher has a golden opportunity to correlate the audio-visual-tactile aids so as to develop the proper basic concepts of truth in the bundles of responsive developing nerves that we call elementary pupils.

MAKING IDENTIFICATION FUN

"Study nature, not books" is excellent pedagogical advice, but with current teaching schedules loaded with triviality it become difficult to follow.

This scheme helps in the study of classification. Collect as many half-pint, round ice cream boxes as pupils in a class, plus about ten extra ones. Used boxes thoroughly washed and dried are satisfactory. Place on the cover of each box a large letter for identification. Inside put bits of plant material such as dry fruits, seeds, woody twigs, small cones, pressed leaves, fern fronds, seaweeds, etc. Pictures of microscopic specimens from out-of-date catalogues of the supply houses and pictures of fruits and flowers from seed catalogues complete the variety. Each box should contain the same number of specimens and each specimen should have a number for identification. Although the boxes are scientifically similar as to contents, they should not look alike.

A key for identification is prepared as each box is filled and is enclosed. The teacher has at least one other copy.

The identification of the specimens is used as a game to see who can correctly identify the largest number of things in a given time. When a pupil finishes his box, he checks his own work from the enclosed key, and corrects his mistakes. Most pupils are good sports about peeking at the keys.

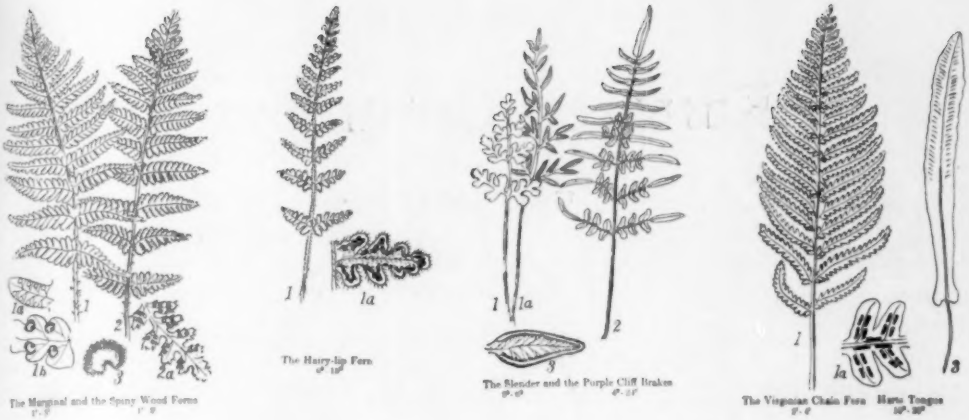
This game is adjustable to various degrees of ability. A slow section will do well to sort and give common names to the specimens with the help of the textbook. Capable groups will be able to use technical terms correctly spelled.

These boxes will last several years, are only a little work to keep in condition, and are easily stored in a carton.

MARION S. HARDING,
on leave from,
Dedham High School,
East Dedham, Massachusetts

THE 2,000TH MEMBER for the current year is Miss Inez L. B. Clough, head of the Science Department, St. Margaret's School, Waterbury 20, Connecticut, and a member of The New England Association of Biology Teachers. The total membership now approximates 2,100. A detailed summary, by states, will appear in the May issue.

REGULAR ADVERTISERS of six or more years standing are: *Bausch & Lomb, American Optical, Denoyer-Geppert, General Biological, Carolina Biological, Marine Biological, Visual Sciences, Chicago Apparatus,* and *Biological Abstracts.* Patronize these advertisers and mention *The American Biology Teacher.*


The Marginal and the Spiny Wood Ferns
The Hairy-lip Fern
The Slender and the Purple Cliff Brakes
The Virginian Chain Fern
Hart's Tongue

Courtesy Slingerland-Comstock Co.

MAY 1946

1.	Chas. Weaver, Paleontologist, b. 1880	17.	John Breukelman, NABT editor, b. 1901
2.	Bert H. Bailey, Ornithologist, b. 1875	18.	Bertrand Russell, Science phil., b. 1872
3.	Henry S. Graves, Forester, b. 1871	19.	Carl Akeley, Taxidermist, b. 1864
4.	Thomas H. Huxley, Biologist, b. 1825	20.	Simon Henry Gage, Zoologist, b. 1851
5.	J. E. Weaver, Botanist, born 1884	21.	Chas. Edwin Bessey, Botanist, b. 1845
6.	G. S. Craig, Elementary Science, b. 1893	22.	1st Nat'l Conf. Outdoor Recreation, 1924
7.	G. W. Wilson, Pathologist, born 1891	23.	Carl von Linné, Biologist, born 1707
8.	Henry Baker, English Naturalist, born 1698	24.	W. F. Hofmeister, Botanist, born 1824
9.	Nature Guiding in Yosemite begins, 1920	25.	James McKeen Cattell, Psychologist, b. 1860
10.	Arbor Day in Montana	26.	W. T. Councilman, Paothologist, died in 1933
11.	Glacier Nat. Park established in 1910	27.	E. G. Wieshuegel, Forester, born 1899
12.	Raymond Ditmars, Herpetologist, d. 1942	28.	Louis Agassiz, Naturalist, b. 1807
13.	Wm. Boyce Thompson, born 1870	29.	M. W. Yale, Bacteriologist, born 1902
14.	Edward Breck, Anti-steel traps, d. 1929	30.	Our "blind spot." See below
15.	William Vogt, Ornithologist, b. 1902	31.	Schuyler Mathews, Bird music, b. 1854
16.	S. R. Powers, Science education, born 1887		

For best suggestion for May 30th other than Memorial Day sent to E. L. Palmer a 365 page 5-year nature diary will be forthcoming. Material similar to illustration will be sent to others cooperating. Send material to 206 Oak Hill Road, Ithaca, New York.

Editorial Comments

Open Letters

To the Producers of Educational Films:

Gentlemen:

During the past several years much progress has been made in the production and use of visual aids in education. Those of us who are teaching the biological sciences recognize and appreciate the contributions to teaching that all of these visual materials and the equipment to use them can make. We especially appreciate the improved quality of motion pictures and filmstrips and wish to give you credit for your part in this progress.

But progress is not stationary, and the prognosis indicates a significant future increase both in quantity and quality of visual materials. And this, of course, indicates the desirability of close cooperation between the users and producers of these visual materials. In line with this procedure the following suggestions from the teacher's point of view may deserve some consideration by those of you who produce films and filmstrips:

(1) If we are teaching subject matter which includes action or movement, a motion picture is desirable; if action or movement are not indicated, a flat picture or filmstrips may be better.

(2) Specific objectives should be carefully considered in the production of a film. We need films which develop proper social and scientific attitudes and understanding, as in the fields of health and conservation, for example. Other objectives to consider include motivation; explanation and illustration of specific subject matter; substitute field trips; and background provision. It would seem undesirable to include more than one of these specific objectives as a basis for any one film. Advertising or descriptive material relating to a given film should indicate this objective so as to help the teacher in selecting films for classroom use.

(3) Since films and filmstrips are used only as an aid to teaching, those which are designed to help in the teaching of specific subject matter should be fairly short; carefully edited to eliminate any material not directly related to the specific subject matter, and should not include material which can best be taught by using other devices.

(4) Teacher's guides and tests are generally desirable; should be made more available and less expensive; and perhaps in some cases shorter.

(5) Educational motion pictures cannot and should not compete in the student's mind with theatrical motion pictures, and we realize that they will have to be used over a much longer period of time. It would be well, therefore, for producers to try to eliminate scenes showing dress, costumes, or other things which will date the picture, unless this is in some way an objective of the picture.

(6) Animated drawings seem to be very effective and popular with science teachers. Color cartoons, such as Walt Disney's *The Winged Scourge*, also seem to be effective. Perhaps more of these types should be added to the production lists.

(7) Production of pictures for specific grade levels and proper cataloguing of them in this manner will be very helpful to the teacher and will help to avoid the often undesirable practice of repeating the same picture to different grade levels.

To the Users of Educational Films:

Dear Fellow-Teachers:

We, too, like the producers of visual material and equipment, have made a great deal of progress in visual instruction. Many books and articles have been written concerning the value and methodology of visual instruction. The teachers of science were among the first to use this type of instruction. But it is not our purpose here to add to these writings, but rather to enter a plea for a more complete and effective use of visual aids in our teaching—for a greater use of the publications which we have, and

for you to make additions to our knowledge of this subject.

We need to make a careful study of what is available in visual materials and new developments in equipment and techniques for using the available materials. The importance of careful and complete planning before using a film or other visual material cannot be overemphasized. Attention to follow-up procedures are likewise very important. Significant correlation with the curriculum is necessary. All these things we know.

But in addition to these matters, we need to think in terms of general organization—within our school system and within our department. This organization should be designed to make equipment and visual materials available, convenient, and practical for the teacher's use.

We also need to think in terms of research—research to find new and better ways of using the materials available; and research to evaluate both materials and techniques. These are jobs for teachers. The public is ready. The road is open. If we have something to learn from the so-called "G.I. Methods of Teaching," let's learn it—and use it.

In the interest of better teaching,

ADDISON LEE,
Guest Editor,
Visual Aids Issue II

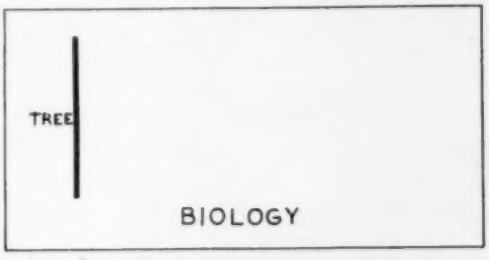
On Teaching the Classification Unit in Biology

ADDISON LEE
Austin High School, Austin, Texas

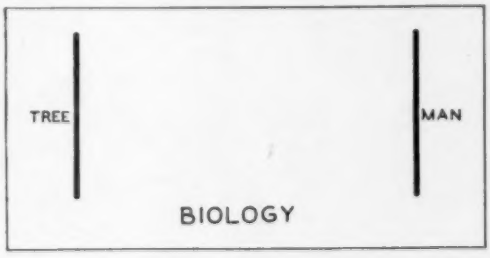
Primitive man, who was a biologist, studied nature and made drawings and diagrams of his findings to be passed on to succeeding generations. Because of this, visual aids of this type are as old as education itself. One of the oldest and still most useful forms of visual aids in education is the use of nature. Close behind nature in use and value is the use of pictures and diagrams. These are useful to improve concepts and get over certain ideas in teaching biology.

The purpose of this acticle is to illustrate with a simple diagram an introduction to the unit on classification of plants and animals in General Biology. It may also be helpful in discussing the interrelationship of the different phyla; or in explaining the similarity of some of the Thallophytes and Protozoa; or perhaps in answering the question on which many biologists disagree: "Is Volvox a plant or an animal?"

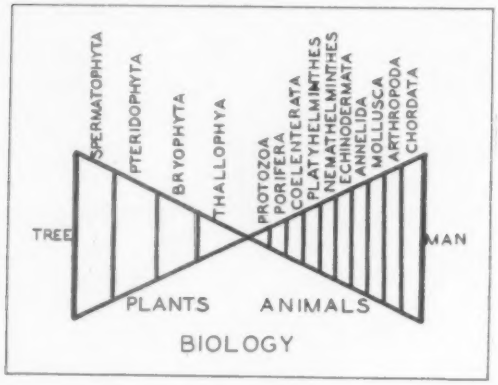
At the blackboard, tell the class you will draw a diagram of BIOLOGY, and ask for an example of one of the highest types of plant life.—A tree.



Let this line stand for a tree. Now ask for an example of one of the highest types of animal life.—Man.



Connect the four extremeties with diagonal lines. Block off four sections for the plant phyla and ten sections for the animal phyla and label them.



Now you can get a picture of the organization of Biology. Volvox, for example, must be located somewhere near where the two lines cross. No one would have any trouble understanding the difference between a man and a tree, but some of the unicellular organisms must be just inside one division or the other and borderline cases may be more clearly understood in relation to the local picture.

This may also be tried sometimes when your students seem to get lost in a maze of phyla names, examples, habitat, and characteristics. Good teaching, we are told, should result when students engage in study, experiments, and other activities, and end up with an organized idea or concept. Perhaps the above diagram will help to do just that.

LETTERS TO THE EDITOR

MIDDLESEX SCHOOL

CONCORD, MASSACHUSETTS

. . . THE AMERICAN BIOLOGY TEACHER for November, 1945, carries a paper by Mr. Julian D. Corrington on the *Inclusion of Ecology in the General Biology Course.* Since his experience is based on work with college students, it may be of interest to high school teachers to hear of a similar experiment but at their level, in an independent secondary school under practically ideal conditions.

The conditions are that the classes are small, averaging only about eight pupils each year; that the school is situated on a tract of over three hundred acres that includes farm land, a wood lot, small streams, a pond, meadows, marshes, swamps and hillsides; that the students are not taking College Entrance Board examinations in biology; and that the instructor is allowed a free hand. . . .

The incentive to experiment is little different from Mr. Corrington's, and so need not be repeated here. What appealed most, perhaps, was the need for a unifying purpose, a single point of view looking at organisms as whole, living things, which are members of an organized community. Back of this was the persistent suspicion that the conventional general biology course at high school level had grown out of the experience of college indoor laboratories before ecology had become a recognized science. Besides, our courses had been designed for schools which, because of their locations and teaching conditions, must limit themselves to more or less conventional indoor work.

So, for the past eight years my biology boys have studied a standard text and done the corresponding laboratory exercises during the fall and winter months, but always with the coming spring work kept in mind. Much of the text has to be omitted, and that is the price that is paid.

In the spring, instead of textbook study and recitations, each boy reads from references and hears talks that are based on ELTON'S *Animal Ecology* but include considerable material from other sources. The reading bears on each student's assigned problem, which is an investigation of one factor in the chosen area where all are working. This outdoor work is in place of laboratory exercises, although the laboratory is freely used to help solve problems. From time to time, in place of lectures, the students compare notes, as, for instance, on food chains.

There you have the opportunity, the incentive, and, in a general way, the experiment itself. The disadvantage lies in the omission of much that is usually covered. The advantage, which seems to offset this, is in the broader point of view toward organisms as whole, living beings, members of an organized, unified community.

Yours truly,

W. J. R. TAYLOR

ITEMS FOR THE FIRST fall number should reach the editor by August 1, 1946.

Heart Valves

REV. JOHN W. BAECHLE
St. Joseph's College, Collegeville, Indiana

It is sometimes difficult to demonstrate to the student just how the valves in the heart actually work. For this reason the following easily made gadget was devised, and is being passed on in hope that other biology teachers may find it a helpful time saver.

A comparison between the valves in the heart and pockets in a rubber apron is not too far fetched. To make a miniature apron with two pockets and another with three pockets requires very little time and hardly any expense. To a rectangular piece of oilcloth, or preferably, rubber sheeting, the pockets cut from the same material are sewed. Several snap fasteners, as shown in the illustrations, are sewed along the edges of the rectangular sheeting. Hooks and eyes will also serve the purpose, and a zipper, if obtainable, would probably be even better. The snap fasteners are naturally sewed in such a way that when they are closed the rectangular piece of material becomes a tube with two or three pockets extending around the inside circumference. If the stitches from sewing the pockets are easily seen on the outside of the tube, they will help the student to visualize the location and position of the pockets inside the tube.

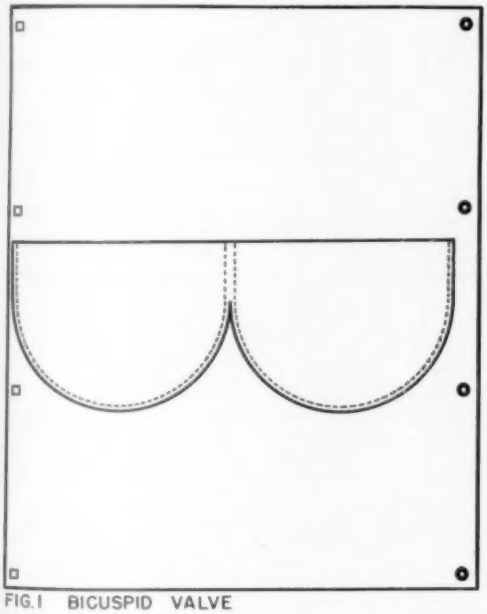


FIG. 1 BICUSPID VALVE

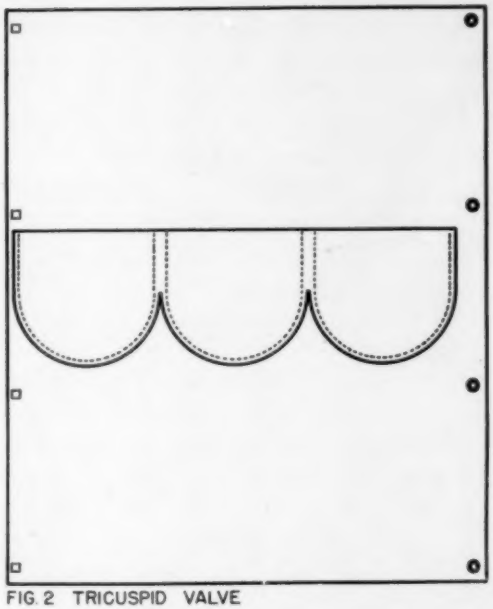


FIG. 2 TRICUSPID VALVE

The teacher can show the student the miniature apron in a flat position, as illustrated, and then change the apron into its tubular form. A few words will convince the student that a liquid can flow through such a tube in one direction without filling the pockets. He will just as readily be convinced that if the liquid were to flow in the opposite direction, the pockets would become filled with the liquid and would bulge out to such an extent as to stop the flow of the liquid. The student will then have learned once and for all the principle behind the one-way heart valves, as well as the difference between a bicuspid and a tricuspid valve.

Methods of Using Films in Teaching Biology

B. F. HOLLAND
The University of Texas

Biology, in general, is the science of living organisms. It deals with many forms of life from a multitude of points of view; but its basic objective is to reveal the laws and principles that underly the behavior of organisms in terms of their structures and environments. High-school biology selects the most significant elements of the general field, and attempts to acquaint young people with the facts and principles governing the interaction of living things to each other and their surroundings, and to introduce them to the problems related to the preservation of good health in their particular communities.

In teaching biology, both teacher and pupils have access to many instructional aids. Real objects, processes, behavior, and other subjects of interest may be observed on excursions and field trips. Public museums may be visited to observe a large variety of specimens. School collections are made and exhibits arranged for a variety of teaching purposes. Use is made of a considerable amount of laboratory equipment for demonstrations and elementary experiments. Microscopes and micro-projectors are introduced and employed in studying the characteristics of micro-organisms. Models are available in many designs for many teaching purposes. Photographs, prints, lantern slides, and stereographs have been made and exhibited to pupils for different purposes. Motion pictures are available for teaching important phases of biology.

To be successfully used, films must have a definite and functional relation to all the other aids and activities within the individual units. They must be introduced at the most effective times so as to fit into the experience of the pupils gained from all other observations and experiences.

Selection of Films

The selection of films for use in biology is one of the major problems of methodology; and in order to select films wisely, the teacher needs to know what films are available, where to obtain them, rental costs, and the purposes they may be used to serve.

The ideal way to select films is to determine the topics, subjects of units to be taught, which require a knowledge of action; and then to find films that depict the action. Unfortunately, the teacher may not be able to solve the problem in this simple and ideal manner; for films have not been produced for every specific subject. Thus, the teacher must start with an examination of lists of available films, and endeavor to find those that fit best into the program of instruction for one or more teaching purposes.

Film Lists. Perhaps the first list of films a teacher should examine for the purpose of discovering what films are available that might be needed in teaching biology is that found in the catalogue of the local film library, where films are most likely to be obtained. With this catalogue in hand, the teacher may look first under the general heading of biology and then under headings related to the units or subjects to be taught. As individual titles are found, it is wise to copy each on a card, and thus start the compilation of a complete list of films.

Other film lists that may be examined are those found in the H. W. Wilson, *Educational Film Catalogue*, and the Educational Screen "1000 and One Blue Book of Non-Theatrical Films." A brief examination of each catalogue will reveal where to look for titles and brief descriptions of the content

of each film. Each catalogue also indicates where each film may be secured. Again, as individual titles are found, a card may be made for each and filed along with those already found in the local film library catalogue.

Information About Films. The title of a film rarely suggests the content in sufficient detail to judge whether to send for it. Thus, before sending for a film, the teacher may want information about which is not given in the film lists. If so, a search may be made in a number of helpful publications, including: The *Encyclopedia of Selected Motion Pictures*, published by the Motion Picture Project of the American Council on Education; "Film News" published by the Association of School Film Libraries, and the new films sections in "Educational Screen" and "See and Hear," and other similar publications. Here the teacher may find detailed descriptions of film content, the purposes a film may be used to serve, and an appraisal of the film for use in classes of different grade levels.

Perhaps the best of all sources of information about films, however, is the teachers manual or guide prepared by producers or specialists for use with each individual film. If such guides can be obtained, the teacher will discover the nature of the content and a variety of suggestions for using the film. Manuals, unfortunately, are not available for all good teaching films; and not all films are described in available publications. Some information may be obtained, of course, from other teachers who have used particular films, and from directors of libraries who have seen them. A teacher would not overlook the possibility of getting information from his fellow-teachers.

Possible Uses of Films. From the information obtained, the teacher may be able to determine particular uses that may be made of each film. She may ascertain, for example, that one film can be used to introduce a unit, another to teach definite facts and principles, another as a review, and another to arouse interest in a unit or field of study. She may also determine, tentatively, whether the film is suitable for the age or grade level at which it is to be used. The particular uses to be made of a film will depend, of course, upon the nature of the content and whether it can be fitted properly into the program of instruction at an appropriate time.

In making a selection, the teacher should remember that a film should have a definite and functional relation to other materials and activities within the unit; and it should be ordered only when it promises to fulfil this general purpose.

Preparation for Film Usage

The teacher should not show a film to a class until she has prepared herself and her pupils for its use at the time chosen to present it. Thus, proper methodology involves, further: (1) teacher preparation, and (2) pupil preparation.

The teacher may prepare herself by previewing and planning the use of a film; and she may prepare the pupils by properly introducing it to them.

Teacher Preparation. When a film is made available to the teacher, she should preview it and plan its presentation, keeping in mind an introduction and possible follow-up activities.

While previewing a film, the teacher may determine: (1) whether the film content is related to the topic, subject, or unit; (2) whether it is related generally or specifically to the facts and principles to be taught; (3) whether it may be easy or difficult for pupils to understand; (4) whether it is adapted or needs adapting to the interests, needs, and capacities of the pupils; (5) whether it enriches materials already covered, or may serve as a background for materials to be taught in the future; (6) whether it contains ideas that should be questioned or criticized; and (7) whether to use the film or return it immediately to the distributor.

Planning a Procedure. During and after the preview of a film, the teacher may plan a procedure for using it. Making use of notes taken during the preview, and of the manual or guide, if one accompanies the film, she may plan a method of introducing the film. This may be done: (1) by making a brief of the content to be presented verbally; or (2) by formulating a list of ques-

tions to be presented to the pupils in a variety of ways. In either case, the teacher should keep in mind the arousal of definite learning attitudes in the pupils. She should plan to make the pupils realize that they are to see the film for definite purposes which they will be called upon to discuss afterward.

In planning a follow-up procedure, the teacher may: (1) Formulate precise questions on the content. (2) Make out questions or problems to refer to individual pupils, in which she knows they are specially interested. (3) List scenes that will need to be supplemented by excursions, still pictures, diagrams, charts, etc. (4) Note down ideas that are to be questioned or criticized. (5) Study the types of questions or activities needed to relate the film content to the ideas already studied and to be studied. (6) List scenes that are similar to scenes with which the pupils are familiar or may be made familiar. (7) Formulate questions on the film which may be included in the next formal test on the unit and the final examination.

Preparing the Pupils. After making definite plans for the use of a film, the teacher should prepare the pupils to see it. It is usually effective to announce a day or two in advance that a film will be presented on the topic or unit at a future meeting, and that reading particular references will help to get the most values from the film. If the film is to be shown in a special room, the pupils should be told where to go.

Further preparation of the pupils will take place just prior to showing the film. At this time, all mechanical preparations for projection should have been completed, and the teacher and pupils will give immediate attention to the purpose at hand.

If the teacher has prepared a verbal introduction, she may: (1) State briefly the nature of the film content, and suggest looking for facts or principles related to the topic or unit, and (2) suggest that the pupils may want to see the film again after a period of discussion following it. If the film is to be introduced by means of questions, these may be written on the blackboard or distributed in mimeographed forms. In either case, the teacher should call attention to the questions and read each aloud while the pupils read and listen. After reading the questions, the teacher should indicate that the pupils may want to ask other questions after they see the film.

Presenting a Film

With the pupils carefully prepared to see it, a film should be run through the projector, the first time it is shown, without stopping for any purpose. After the first showing, and a discussion of the content, the same film may be shown several times and stopped and started as many times as there are reasons for doing so. Repetitions, as a rule, should be a practice only when there are difficult portions or when reshowings are requested by a number of pupils. Before showing a film again, the teacher should state clearly the reason or purpose; and following each showing, the teacher should concentrate attention on the purpose and the additional facts and principles related thereto.

Though some projectors are equipped with devices for stopping a film to show individual pictures, these devices should be used sparingly or not at all. Single pictures rarely ever appear in clear detail and they are lacking in brilliance. If stills are needed to clear up particular points, these should be prepared as a follow-up activity and presented by means of a still projector.

The best place to present a film is in the regular classroom. If this is not equipped for projection purposes, the next best place is a special projection room. If an auditorium is used the pupils should be seated close together in front of the screen; so that all may see the pictures clearly, hear the teacher's introductory remarks, and engage in the discussions planned to follow the film.

As a rule, moreover, only one class should be shown a film at any one time, unless two or more classes are studying the same unit and each is prepared in advance. Unless there are very definite reasons for doing so, only one film should be shown during a class period. The class period is rarely long enough to make use of more than one film, for the larger portion of a period should

be taken up with preparation and follow-up discussions and for showing the film as many times as necessary to get the most out of it.

Follow-up Procedures

Follow-up activities may consist of: (1) Discussions, (2) tests, (3) written summaries, (4) excursions, (5) still pictures, (6) readings, and (7) pupil commentaries.

Discussions. Perhaps the best way to start a discussion of the content of a film is for the teacher to concentrate attention of pupils on the questions and problems used in preparing them for it. As these are discussed, the pupils should be encouraged to ask and answer other questions related to or suggested by the film. The teacher should have a number of thought questions to ask in case the discussion should lag; and the pupils may be encouraged to raise and answer similar questions. Questions raised that are not definitely answered by the film may be referred to individual students for future reports.

Tests. Formal tests on film content are effective when the film is shown as a review of a topic or unit. Tests on films shown only once, either as introductions or definite teaching aids, are often distasteful to pupils. An objective test on the content may be given as an exercise to reveal to the pupils the need for careful attention to film content. Items from such a test may be selected for inclusion in a general test over the unit and in the final examination, but the pupils should not be held accountable for questions that they have not had opportunity to study in other ways than from a film.

Readings. The teacher should almost invariably have a set of references for pupils to read as a follow-up activity. Carefully selected to include materials related to the film content, references may take the pupils into many by-paths of worthwhile learning.

Pupil Commentaries. It is often effective to show a film several times and ask individual pupils to comment on the content. In the case of sound films, the sound may be cut off and the pupil may talk into a microphone.

Excursions. A film may suggest the need for an excursion or a field trip, in order to secure first-hand impressions of objects depicted. If so, the pupils may be prepared therefor by making notes on things to observe. A reshowing of the film as a follow-up to the excursion may be effective.

Still Pictures. Some producers make filmstrips and lantern slides to use with films. Consisting of individual pictures made directly from selected scenes in the film, these are excellent for use in follow-up study. Teachers may also collect pictures dealing with the content of the film, and exhibit these in the follow-up. Arranged to broaden experiences of pupils, carefully selected pictures often stimulate considerable discussion.

That Students May See

BROTHER H. CHARLES, F.S.C.
St. Mary's College, Winona, Minnesota

Do your students assure you that THEY see in the microscope just the things YOU see and describe to them? And later, do their descriptions and drawings indicate that they actually did see the things clearly? How frequently are we brought to the realization that the students **do not focus** their scopes accurately, that they look at hazy images, and, that **they do not see!** Investigations into the world of the tiny and almost invisible **may** be and **should** be delightful experiences for the high school student. They **can** be. But so many times they are real drudgery rather than big thrills of life. And this, to a very

great extent, because of the presentation by the teacher and the equipment available to him.

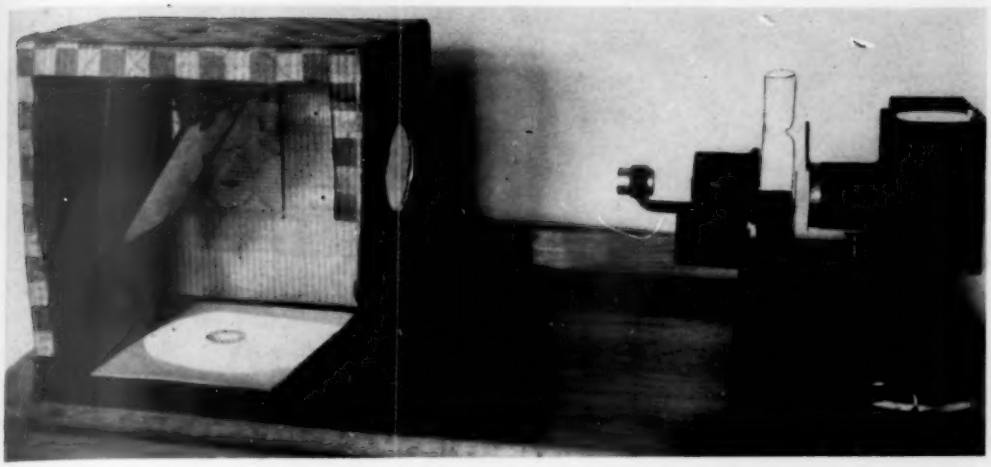
The present-day teacher is laboring, as all of us realize, under handicaps of reduced time and increased teacher load occasioned by accelerated schedules and reduced personnel. In order to make his teaching effective, he is forced to tax his resources to the utmost. Visual aids have long been potent means of presenting certain necessary subject matter. In some situations, any other method is a poor substitute. Teaching about the microscopic world is certainly one of these situations.

But WHAT visual aids should be used, and HOW? The teacher today cannot afford to content himself with any but the most effective aids at hand. Pictures are not as effective as actual specimens and will not be considered here. Tiny specimens can be seen through the microscope or be shown by means of the microprojector. The value of the microscope has long been recognized, though there is a growing tendency to consider microscope work by high school students a waste of time. (In many cases, because of the methods of instruction, this is not far wrong.) All too frequently much valuable time is lost, discipline problems arise, and interest is either dulled or lost when students get their first assignment requiring the use of the microscope. They usually spend more time learning how and what to see than in seeing. The instructor supplements his general instructions by helping a few individuals while most of the class strives ineffectually to work out their assignment and a miserable time is had by all. I feel confident that microscopic work can be made interesting and efficient if it is preceded by a judicious use of a microprojector.

The microprojector has a well-recognized value, but it is not widely used in high school laboratories for several good reasons. The first microprojectors were complicated and expensive. They required very dark rooms for satisfactory use. These objections still hold for apparatus built for high magnifications. Low-power microprojectors are free from these disadvantages and warrant more general use.

Low-power projectors have distinct advantages for use in your laboratory. They are relatively inexpensive. They are sturdily constructed and can be operated effectively even by the students. Both the magnifying unit and the light source are mounted on one solid piece which prevents the shifting of either from the optical axis. The light is strong enough to project a brilliant image in a semi-darkened room. (Remember: The brilliance and clarity of the image is inversely proportional to both the distance from the screen and the darkness of the room.) They are compact, easily moved, operate in almost any position, and require little time to set in operation. Wood sections, insect parts, and almost any of the larger specimens through which light passes readily can be projected satisfactorily. Where few specimens are available a single specimen can be used in instructing an entire class. Almost any lesson can be made more interesting if wisely selected specimens are projected on a screen as they are discussed in the lesson. Whenever possible, microscope work by individual students will be more efficiently done if one of the specimens to be studied is first projected, explained, and its characteristic features pointed out. Review of work done either in the classroom or in the laboratory can be conducted more profitably if specimens are projected and explained by either the teacher or the more apt students.

It may be that your laboratory has no adequate microprojector. In this case, an experience of mine may be helpful.



After enjoying the advantages of a good microprojector for many years, I was transferred to a school having most meager projection equipment and an even more meager budget. Since I consider the microprojector a necessary part of my teaching equipment, I made a survey of what might be made to serve temporarily. There was a microprojection attachment for a projection lantern but no lantern. The lamp for the binocular microscope uses a 200-watt lamp and offered a possible light source. The projection unit was mounted on a board and attached to the lamp. Since the heat generated by the lamp injured the slides, a Kolle culture flask was fitted onto the board between the lamp and the projection unit to serve as a water cell. This apparatus, born out of necessity, has become the most used instrument in my laboratory. With it, groups ranging from few to forty receive instruction on stem and root sections, leaf venation, insect parts, chick embryos and any other large specimens where the demonstration of gross anatomy is sufficient. Even parts of 2×2 film slides are projected. It is available to all students and is used by small groups in private studying, in "bull" sessions, and as an adjunct in drawing.

Most children lack proportion in their drawings. They can be taught proportion, but time is limited and such instruction often breeds disgust for the subject occasioning it. Rather than instruct children how to draw in the laboratory some teachers avoid this difficult problem by issuing either partially complete drawings on which the student fills in minor details, or completed drawings to be labeled. A few sidestep drawing entirely by requiring only written or oral descriptions of things to be observed. Since I regard the drawings by students as the best indices of their observations, I sought means to aid the students in securing accuracy of outline and of proportion. I thought a device which would enable students to trace the principal outlines of a projected image would solve the problem.

The crudely made microprojector described above plus a large carton and a mirror from a dime store were all the material needed. One side was removed from the carton and a round hole was cut in the right end. The mirror was placed inside the carton at an angle of 45° and in such a position that the beam of light from the projector entering the carton through the hole would be reflected onto the drawing paper with a

minimum of distortion. When the carton is placed with the open side away from any strong light source, such as a window, drawings are made without darkening the room. The size of the projected image is regulated by the distance between the projector and the carton. Since the projecting lens has low resolving power the larger details are most distinctly shown. These can be traced on the paper and, if necessary, the minute details can be filled in by studying the same specimen under a compound microscope.

The entire apparatus is simple, sturdy, and easy to operate. It is kept on an open shelf in the laboratory ready for use by both teacher and students. Twelve years of service have not affected its usefulness, and barring an accident, such as being dropped on the floor, it is expected to give service for at least another generation.

The above described use of relatively "dead" laboratory apparatus is not unusual. I present it in the hope that others will describe in this journal the useful gadgets they have constructed. I would also strongly suggest that microprojectors now gathering dust in some laboratories, and I have seen some, be used.

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The Business Meeting of the *Executive Board* and also those of the *Representative Assembly* and *Editorial Staff* were attended, as were the program meetings. A report of business transacted and of matters that were discussed in reference to future activities will appear in the May issue.

As in the past the journal will bring, in early issues, to those readers who could not attend the meeting, various of the papers and addresses presented.

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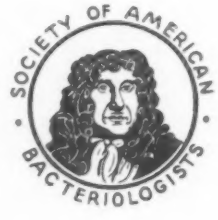

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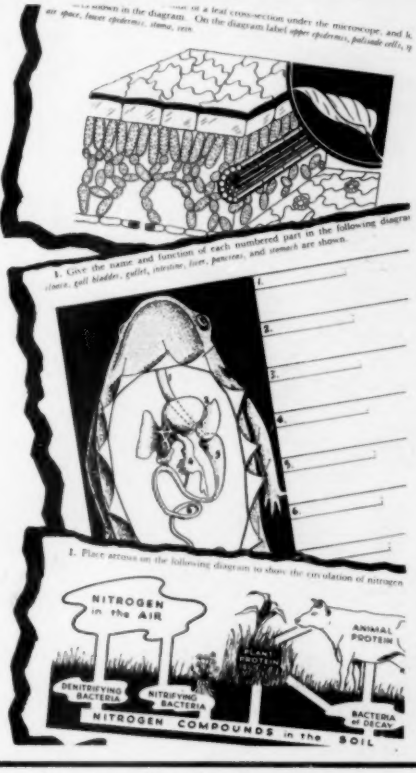

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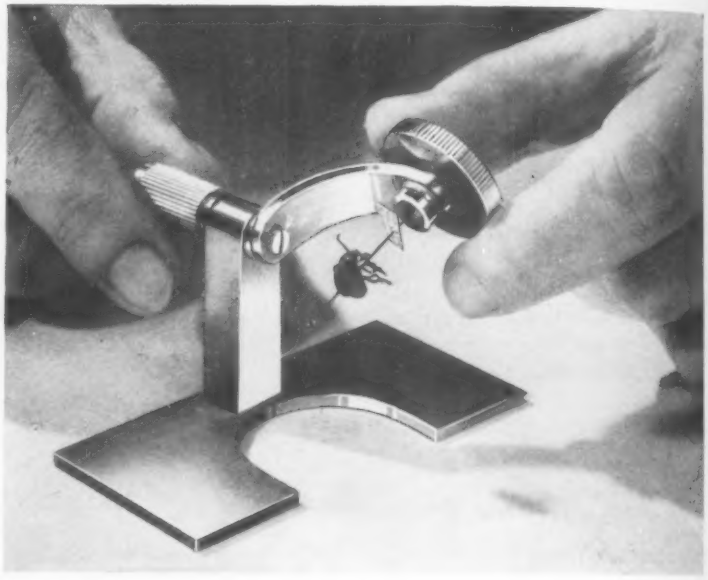

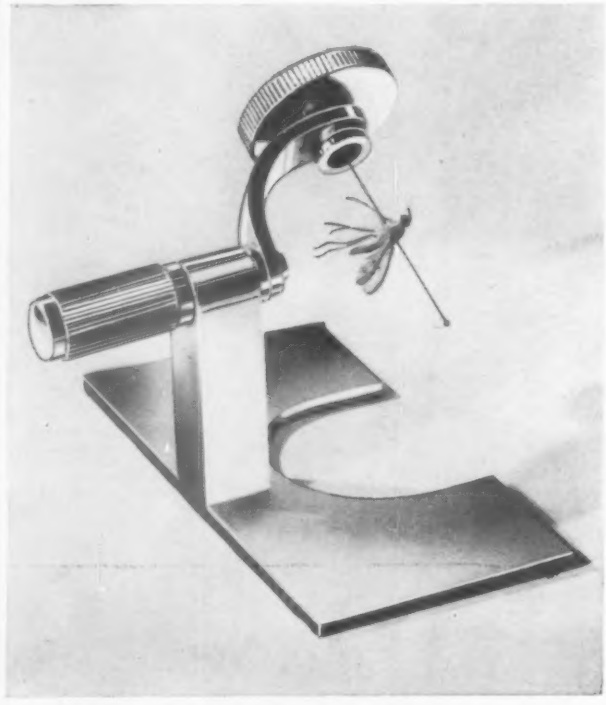

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